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Numerical methods

MME308

Assignment 6

Grop.

Problem no: 4,8,10

fall 2014

Problem 4

Given :

$$X= \int_a^b \left(2000 \ln\left[\frac{140000}{140000-2100\,t}\right] - 9.8\,t\right) dt$$

A=0 b=25

$$\textbf{F(x)} = \left(2000 \ln\left[\frac{140000}{140000-2100\,t}\right] - 9.8\,t\right)$$

Required :

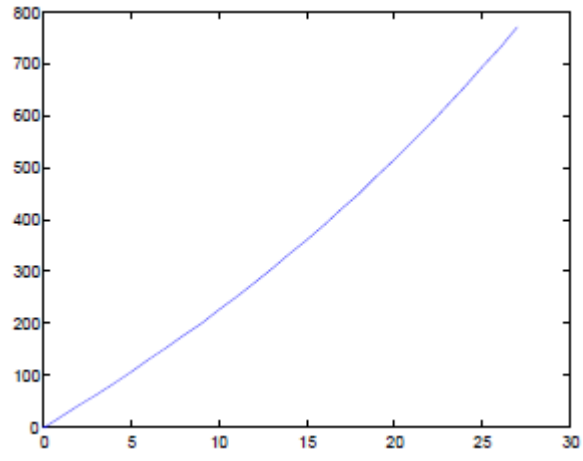
a) Use single segment trapezoidal rule find distance between a= 0 and b=25 second
b) B) use five segment (n=5) trapezoidal rule find distance between a=0 and b=25 second
c) Find the absolute relative error between(a) and (b)

Solution :

When using mat lab program the true integration value :

$\int_0^{25} f(x)dx$ =7770.5309

a)



$$\textbf{F(a)} = \left(2000 \ln\left[\frac{140000}{140000-2100\,t}\right] - 9.8\,t\right) = 0$$

$$\textbf{F(b)} = \left(2000 \ln\left[\frac{140000}{140000-2100\,t}\right] - 9.8\,t\right) = 695.0073$$

I =(b-a) $\frac{f(a)+f(b)}{2}$ = (25-0) $\frac{f(0)+f(25)}{2}$ =(25-0) $\frac{(0)+(6958.0073)}{2}$

=8687.5907

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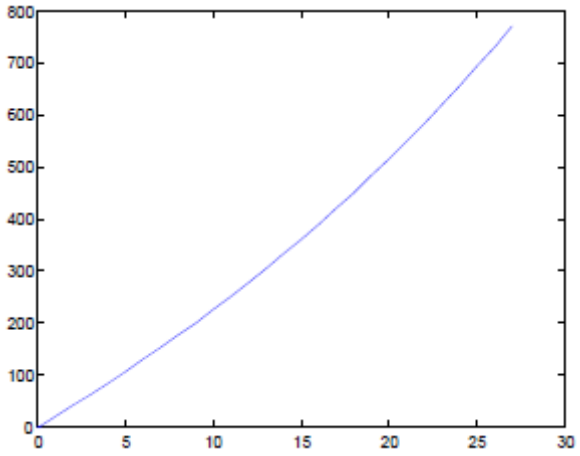
b)

$\Delta x = \frac{b-a}{n} = \frac{25-0}{5} = 5$



X	0	5	10	15	20	25
F(x)	0	106.9231	227.0379	362.7845	517.3499	695.0073

=(5-0) $\frac{(0)+(106.9231)}{2}$ = 267.3077

=(10-5) $\frac{(106.9231)+(227.0379)}{2}$ = 834.9025

=(15-10) $\frac{(227.0379)+(362.7845)}{2}$ =1474.556

=(20-15) $\frac{(362.7845)+(517.3499)}{2}$ =2200.336

=(25-20) $\frac{(517.3499)+(695.0073)}{2}$ =3030.893

7807.9952

c)

$$|\epsilon_a| = \left|\frac{8687.5907 - 7807.9952}{8687.5907}\right| \times 100$$

$$|\epsilon_a| = 10.12$$

Problem 8 :

The velocity of a body is given by :

a) V(t) = 2t, $1 \leq t \leq 5$
b) $V(t) = 5t^2 + 3$, $5 < t \leq 14$

Required :

Use two-segment Simpson 1/3 rule to compute the distance in meter covered by the body from t=1 to t=7 seconds most

Solution :

a)

$$\mathbf{h = \Delta x = \frac{b-a}{n} = \frac{7-1}{2} = 3}$$

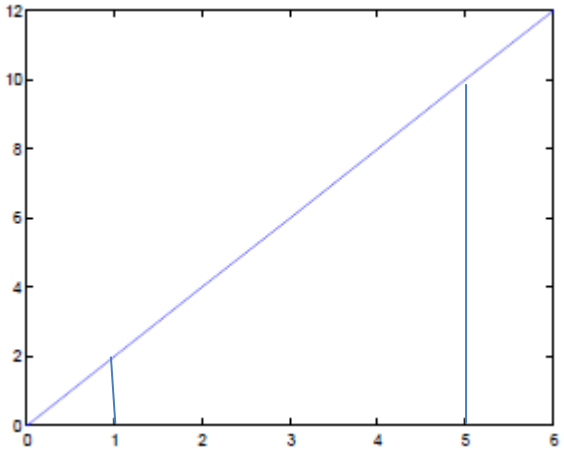


figure1: V(t) = 2t

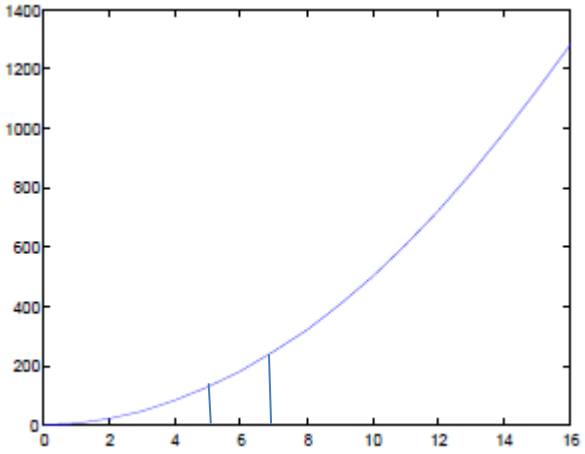


figure2 V(t)= $5t^2 + 3$

X	**1**	**4**	**7**
F(x)	**2**	**8**	**248**

$I = \frac{h}{3} [f(x_0) + 4 f(x_1) + f(x_2)]$

$I = \frac{2}{3} [2 + 4*8 + 285] =$

I = 282 m

Problem 10 :

Given:

X	0	0.10	0.20	0.30	0.35	0.40	0.55	0.70	0.85	0.90	0.95	1
F(x)	2	1.72	1.84	1.28	1.18	1.10	0.88	0.7	0.56	0.52	0.48	0.45

Required

Evaluate the integral of the tabular data from 0 to 1 by Simpson's rules .

Solution :

X	0	0.10	0.20	0.30	0.35	0.40	0.55	0.70	0.85	0.90	0.95	1
F(x)	2	1.72	1.84	1.28	1.18	1.10	0.88	0.7	0.56	0.52	0.48	0.45

H=0.1 h=0.05 h=0.15 h=0.05

At h = 0.10

X	0	0.10	0.20	0.30
F(x)	2	1.72	7.84	1.28

$I_1 = \frac{3h}{8}(2+3*1.72+3*1.48+1.28) = 0.483$

At h = 0.05

X	0.30	0.35	0.40
F(x)	1.28	1.18	1.10

$I_2 = \frac{h}{3}(1.28 + 4*1.18 + 1.1) = 0.11833$

At h =0.15

X	0.4	0.55	0.70	0.85
F(x)	1.10	0.88	0.70	0.56

$I_3=\frac{3h}{8}$ (1.1 + 3*0.88 + 3*0.7 + 0.56) = 0.36

At h =0.05

X	0.85	0.90	0.95	1
F(x)	0.56	0.52	0.48	0.45

$I_4=\frac{3h}{8}$ (0.56 + 3*0.52 + 3*0.48 + 0.45) =0.0752

I_{TOT}=0.483 +0.1183 +0.36 +0.0752 = 1.0365